Original Article

OCCURRENCE OF PSEUDOMONAS AERUGINOSA IN POST-OPERATIVE WOUND INFECTION

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ABSTRACT

Objective: To determine the prevalence of *Pseudomonas aeruginosa* in Post-Operative Wound Infection.

Design: Swab samples were collected from patients who had undergone operation, sinks, washbasins, floor and nursing staff within the different wards of Lagos University Teaching Hospital, Idi-Araba, Lagos, Nigeria.

Settings: The samples were obtained from the wards in the hospital and processed in the department of Medical Microbiology of the hospital.

Main Outcome Measures: Assessment of *Pseudomonas aeruginosa* as an agent of nosocomial infections.

Results: Out of the 60 bacterial isolates found in post-operative wound infection, 20 (33.3%) were *Pseudomonas aeruginosa*, followed by *Staphylococcus aureus* 13 (21.7%), *Klebsiella* species 10 (16.7%), *Escherichia coli* 7 (11.7%), Atypical coliform 4 (6.7%), *Proteus* species 4 (6.7%), *Streptococcus pyogenes* 1 (1.7%) and *Enterococcus faecalis* 1 (1.7%) in that order. *Pseudomonas aeruginosa* infection was higher in female than male, ratio 3:2 and was found more among young and elderly debilitated patients. The *in vitro sensitivity pattern of 20 isolates of Pseudomonas aeruginosa showed colistin (100%), gentamicin (75%), streptomycin (30%), and tetracycline (10%).*

Conclusion: *The role of Pseudomonas aeruginosa as an agent of nosocomial infections is re-emphasised.*

KEY WORDS: Post-operative wound, Infection, *Pseudomonas aeruginosa*, Occurrence, Nosocomial.

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INTRODUCTION

Post-operative wound infection simply means wound infection after surgical operation[1]. The rate of post-operative wound infection vary from one hospital to another[2]. It has been shown that surgical wound infections may occur shortly after surgery or several days post-operatively, and that the site of infection may be limited to the suture line or may extend into the operative site[1,2]. Maniatis et al[3] suggested that deep-seated sepsis developing a few days after an operation and before the wound has been dressed reflect a theatre infection. Ward infections tend to be more superficial and frequently follow the dressing of wounds in the ward. Similarly, skin infection

such as boils or abscesses developing at sites other than the operation site indicate that the infection was acquired in the ward[2,3].

The virulence and invasive capability of the organisms have been reported to influence the risk of infection, but the physiological state of the tissue in the wound and immunological integrity of the host seem to be of equal importance in determining whether infection occurs[2]. Although not invariable, microbial densities of 10^5 or more organisms commonly indicate infection with less count reflecting contamination[4]. Bacteriological studies have shown that post-operative wound infection is universal and that the bacteria types present vary with geographical location, bacteria resident on the skin, clothing at the site of wound, time between wound and examination[4,5]. Within recent years, there has been a growing prevalence of Gram-negative organisms as causes of serious infections seen in many hospitals. These organisms have almost replaced Staphylococcus aureus in nosocomial infection. Of the Gram-negative bacilli, Pseudomonas aeruginosa has been of particular interest[6]. The incidence of Pseudomonas aeruginosa in post-operative wound infection is becoming more serious in developing countries because of relaxation in general hygienic measures, mass production of low quality antiseptic and medicinal solutions for treatment, difficulties in proper definition of the responsibility among the hospital staff[7]. The hospital-acquired nature of infections with Pseudomonas aeruginosa has been noted and while some patients suffer endogenous infections, the vast majority are acquired from exogenous sources. It has also been observed that healthy carriers of Pseudomonas aeruginosa in the hospital environment account for about 28% while less in the open community[8]. The objective of this study was to determine the occurrence of Pseudomonas aeruginosa in post-operative infection and its susceptibility to commonly used antibiotics.

MATERIALS AND METHODS

Specimen:

Post-operative wound samples (swabs) were collected aseptically with sterile cotton wool swab from different wards in the hospital.

Media:

The following media were used in this study: blood agar, MacConkey agar, cetrimide agar, chocolate agar, nutrient agar and slopes, peptone water and Simmon citrate agar. The media were prepared according to manufacturers' instructions in 500 ml bottle and sterilized by autoclaving at 121^0C for 15 minutes.

Biochemical tests:

The reagents and media used for biochemical test included oxidase reagent, indole reagent, Simmon citrate, glucose, Kiigler-iron agar and motility indole urea. Results were reported according to standard procedures[9].

Methods:

All wound swabs collected for bacteriological investigations during the period of this study were treated according to established method of treating wound swabs[9]. Gram stain preparations were made from all the swabs.

Incubation of plates:

The plates were incubated at 37^0C for 18-24 hours in an incubator. The plates were read the following day but extended to 48 hours if there was no bacterial growth within 24 hours. Isolated colonies were subjected to Gram staining technique and biochemical tests for identification.

Identification:

The primary identification of Pseudomonas aeruginosa and other bacterial isolates were made based on colonial appearance, pigmentation, oxidation-fermentation test, oxidase test, indole test, ability to grow on cetrimide agar, Gram reaction, motility test and other biochemical tests.

Antibiotic testing:

Antibiotic sensitivity tests were carried out on isolated and identified colonies of Pseudomonas aeruginosa using commercially prepared antibiotic sensitivity disc using Kirby-Bauer method. Antibiotic testing was not done on other bacterial isolates in this study since our focus was on the occurrence of Pseudomonas aeruginosa.

Control organism:

Standard strains of Pseudomonas aeruginosa (NCTC 10662) and Escherichia coli (NCTC 10561) were used in controlling all tests carried out in this study.

RESULTS

A total of 80 samples were collected, 60 of which were samples from surgical, paediatric, orthopaedic, obstetrics and gynaecology wards. Twelve samples were obtained from sinks, washbasins and floor and eight from nursing staff. Table-I shows the occurrence of Pseudomonas aeruginosa and other bacterial pathogens isolated from post-operative wound. Table-II shows the types of operation, number and percentage occurrence of Pseudomonas aeruginosa isolated in each operation. Table-III shows the occurrence of pseudomonas aeruginosa in post-operative wound infection in relation to age and sex. The age groups were categorised into three: 0-29, 30-59 and 60 and above. The result showed that the occurrence of Pseudomonas aeruginosa was higher in the young (15%) and the elderly people (10%) than in the age group of 30-50 years (8.3%). The result of this study also showed that the longer a patient stays in the hospital, the higher the chances of being infected with bacteria particularly with Pseudomonas aeruginosa. Three isolates of Pseudomonas aeruginosa were isolated from the hands of eight nursing personnel that were swabbed. Table-IV shows the sensitivity pattern of Pseudomonas aeruginosa isolated from post-operative wound. The organism was sensitive to colistin, gentamicin, streptomycin and tetracycline with colistin showing the highest percentage sensitivity but was resistant to ampicillin and cotrimozaxole.

Table-I: Occurrence of bacterial isolates in post-operative wound infection

Pathogens	*Total number isolated*	*% Isolates*
Pseudomonas aeruginosa	20	33.3%
Staphylococcus aureus	13	21.7%
Klebsiella species	10	16.7%
Escherichia coli	7	11.7%
Atypical coliform	4	6.7%
Proteus species	4	6.7%
Streptococcus pyogenes	1	1.7%
Enterococcus faecalis	1	1.7%
Total	60	100%

Table-II: Occurrence of Pseudomonas aeruginosa in post-operative infection as seen in different types of operation (n=20)

Type of operation	*No. P. aeruginosa*	*% P.aeruginosa*
Mastectomy	3	15%
Laparatomy	1	5%
Appendicectomy	1	5%
Pyloromyotomy	1	5%
Haemorrhoidectomy	1	5%
Myomectomy	1	5%
Cystolithrotomy	1	5%
Colostomy	2	10%
Prostatectomy	0	0
Gastrojejunostomy	0	0
Cystostomy	0	0
Thyroidectomy	0	0
Gastrectomy	0	0
Thoracotomy	2	10%
Caesarean section (C / S)	5	25%
Cholecystectomy	2	10%
Pyloromyotomy	0	0
Herniotomy	0	0
Urethroplasty	0	0
Osteotomy	0	0
Amputation	0	0
Total	20	100%

Table-III: Occurrence of Pseudomonas aeruginosa in post-operative wound infection in relation to age and sex (n=20)

Factors	*No. Samples*	*No. P.aeruginosa*	*% P.aeruginosa*
Age:			
0-29	28	9	15%
30-59	22	5	8.3%
60 and above	10	6	10%
Total	60	20	33.3%
Sex:			
Male	28	8	13.3%
Female	32	12	20%
Total	60	20	33.3%

Table-IV: Sensitivity pattern of Pseudomonas aeruginosa isolated from post-operation wound infection (n=20)

Antibiotics	*% sensitive*
Colistin	100%
Gentamicin	75%
Streptomycin	30%
Tetracycline	10%
Ampicillin	0%
Cotrimoxazole	0%

DISCUSSION

The primary aim of this study was to determine the occurrence of pseudomonas aeruginosa in post-operative wound infection and its sensitivity pattern to commonly used antibiotics. The results obtained showed a high incidence of Pseudomonas (33.3%) of all the pathogens isolated from the post-operative wound in the different operations. Joshi[7] recorded prevalent rate of 6.8%. The result of our study is higher than that reported by Joshi. This could be attributed to differences in geographical location and hygienic measures. This also revealed the increasing incidence of Pseudomonas aeruginosa in post-operative wound infections as observed by other scientists especially in recent years. Joshi[7] quoting Najak stated that pseudomonas aeruginosa has almost replaced Staphylococcus aureus in post-operative wound infection and reported that Najak documented 16.8% for pseudomonas aeruginosa and 5.6% for Staphylococcus aureus. It is thus clear that the prevalent rate of Pseudomonas aeruginosa recorded in this study is in agreement with what is obtained in other hospitals. Furthermore, this work indicates that the occurrence of Pseudomonas aeruginosa in post-operative wound infection is dependent on age, sex and duration of stay in the hospital. The infections were more common in young and elderly debilitated people, a ratio of 1:1.5. Pseudomonas aeruginosa was isolated from the hands of the nursing staff. This is in agreement with Cruse[10] who reported that the hands of nurses working in wards with infected patients often carry Pseudomonas aeruginosa. The isolation of this organism from the hands of nursing staff may reflect the level of hygienic measures in the hospital. The susceptibility pattern of the 20 isolates of Pseudomonas aeruginosa to some commonly used antibiotics as reported in this study is similar to that of Joshi[7] and Opara[11]. In general, the increased rate of occurrence of Pseudomonas aeruginosa is not unrelated with indiscriminate use of antibiotics without laboratory diagnosis and antibiotic sensitivity report. This single factor could eliminates the normal flora and provide a non-competitive environment for Pseudomonas aeruginosa. The resistant nature of the organism to antimicrobial agents, nutritional versatility and the difficulties encountered in maintaining proper hygienic standards especially among personnel involved with wound dressing and general care of patients may have contributed to the high rate of Pseudomonas aeruginosa infection. The prolonged stay in the hospital following an operation as observed in this study is important and this factor played a significant role.

CONCLUSION

This study shows that there is an increased rate of incidence of Pseudomonas aeruginosa in post-operative wound infections. This is in agreement with survey studies carried out in various hospitals both nationally and internationally. The infection appears to be common in hospitals with relaxed hygienic measures and is dependent on age, sex and duration of stay in the hospital.

RECOMMENDATIONS

The following recommendations are invaluable:

* All personnel who are handling post-operative wound should be taught the principle and practice of aseptic technique.
* Samples of disinfectants and antiseptics used in wards and surgical theatres should be sent to the laboratory regularly for evaluation of its efficiency against members of the genus Pseudomonas and in particular Pseudomonas aeruginosa because of its medical importance.
* Regular clinical meetings should be organised to discuss and review methods of handling clinical specimens.
* Wounds should not be exposed for prolonged period unduly during the course of dressing.
* There should be good communication between the infection control unit and the hospital authority.
* Patients with nosocomial infection should be separated from other patients to avoid cross-infection.

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